

N.J. Meadows (Cunningham)
Man's 300-Year Effort to Conquer
Jersey Meadows Still Hampered By

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NATURE'S 125,000,000-YEAR

STRANGE things happen in the Jersey Meadows:

A huge stamping machine in a meadowland factory near Newark pounds down, and with each pound a house two blocks away jiggles up and down an inch or two, like a little boy on a see-saw when his heavier father on the opposite end strikes the ground.

Engineers start an 80-foot-long pile downward near Overpeck Creek. The thumping pile driver pounds once or twice and the pile moves slowly through the earth. Suddenly, on the second or third pound, the pile slides downward 35 to 50 feet, as if it were a hot nail in soft butter.

One corner of a giant building near Kearny rests on solid rock, as steady as the Rocky Mountains. Less than 200 feet away the same structure rests on hundreds of piles reaching down through soft clay to bed rock more than 125 feet from the surface.

These things—the dancing house, the “hot” pile and the wedding of rock and mush in one building—emphasize that 20th century ingenuity can come to naught if it ignores the violent forces which shaped this great open tract through geological time. Whoever frets that man in 300 years hasn't conquered the meadows must be aware that it took 125 million years, and then some, to make the area what it is today.

SNAKE HILL is the chief meadowlands monument to geological time, rearing its volcanic rock head 202 feet above the marshes in full view of New Jersey Turnpike and Pennsylvania Railroad riders. Little Snake Hill, to

Volcanoes, mighty upheavals and glacial ice sheets made the Jersey Meadows what they are today. This second in a series of articles on the meadows tells why modern man must understand the lessons of 125 million years of geological time.

the east, is a 78-foot-high monument formed at the same time but nature could spare only enough lava flow to make an eminence big enough for a Coca-Cola sign.

These rock twins (despite their size disparity) were born some 125 million years ago and their birth took place deep under the earth's surface—a mile or more under. That they are visible monuments at all is a tribute to the power of erosion through millions of years.

If Snake Hill (or Laurel Hill, as some Hudson County leaders insist)



Snake Hill, 202-foot volcanic rock, appears flat in this air photo. Flanking it are the N. J. Turnpike and Hackensack River. Pennsylvania Rail Road tracks are at left. Small bridge across river is crossing of the Greenwood Lake branch of Erie Rail Road. **BELOW:** Little Snake Hill, a 78-foot monument to eons past, bears huge ad. Geologists say both hills are about 25 million years old.



HEAD START

and Little Snake Hill are solid testimonials to passing geological time, then what surrounds them beneath the meadows is an eloquent, but unstable, memento of the much more recent ice age.

Scrape off the peaty crust, say down eight or 10 feet, and the meadowland stands revealed as water-logged clay. This may be a few feet thick or it may be 200 or more feet thick, depending on the location. Whatever the location, whatever the depth, the clay tells an unmistakable story: The story of a huge fresh water lake which thousands of years ago lapped the rocky shores of Bergen Ridge on the east and the rocky hills to the west.

Sometimes these thick, rich clays have been useful.

THE earliest Dutch settlers discovered the value of the clay banks in the meadows. They used the clay as mortar to bind the red sandstones of their homes, as plaster for their walls and ceilings and as linings for their chimneys. Some early makers of pottery also found the meadowlands clay suited their mouldings.

Brickmakers swept into the area. Hackensack's six brick yards produced 9,500,000 bricks annually in the 1870s but by 1880 the industry centered in Little Ferry. The extensive Mehrhof pits, kilns and yards produced more than 100,000 bricks daily in 1880 and in 1895 Mehrhof and three competitors produced 100 million Little Ferry bricks a year.

Little Ferry became the second biggest brick center in the United States. Brick-laden barges constantly plied the Hackensack and, more colorfully, the Hackensack "windjammers" raised their sails to swoop meadowland bricks off to market.

Brick making is no longer a great industry in this marshy area of Bergen County, although one brickmaker still turns out quantities at Carlstadt. His deep pit on the Carlstadt-Moonachie border proves that the clay which geological time took so long to lay down is still there for the digging.

More often, though, meadowlands clay is the villain of the piece.

IT is clay which gobbles long piles much as a robin swallows worms. It is clay which would ruin heavy buildings if they weren't piled. It is the clay which makes builders of highways and railroads cautious. And, it is the peculiar meadowlands loose clay formation known as "bull's liver" which cause the shaking and shuddering.

State Geologist Kemble Widmer attributed the shaking house in the Newark meadows to a "bull's liver."

The factory with the stamping machine, threatened with a law suit, called him to ask if geologists thought it possible that a pounding press could shake a house two blocks away.

Yes, answered Dr. Widmer, the down beat of the stamping machine could be picked up in a layer of quivering clay, transmitted laterally, and then rise upward to make the house tremble.

Dr. Widmer never heard how the law suit was settled. "People only call me at the beginning of a case," he says with a grin. "They never tell me the outcome."

NOW, however, Dr. Widmer is set to do some telling of his own. His office has completed a survey of meadows underground which may bring significant changes in thinking about some facets of the area's geology. For one thing, he and his assistants seem to have definite evidence that long ago two major streams cut channels down the Hackensack Valley.

Spurred by investigations of the Passaic Valley Citizens Planning Assn., the state geology department began to chart all known borings in the meadowlands. Such a chart has long been needed; the value to an engineer in knowing that bedrock is 50 feet or 100 or 200 feet from the surface is obvious—and without such knowledge a man who builds in the meadowlands might find himself with feet of clay.

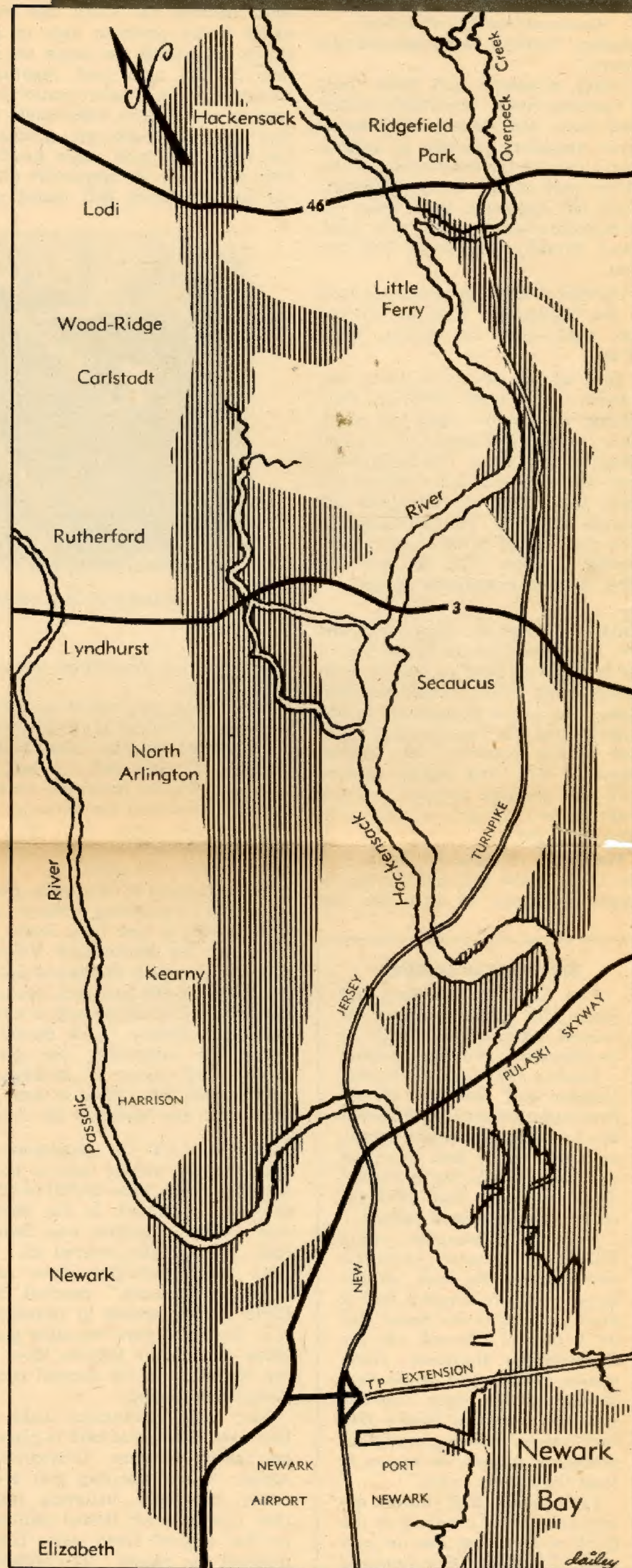
Plotting the depths to bed rock, the state geologists readily confirmed what has long been accepted—that a wide stream once flowed close to the western rock ridge on which rests the string of towns from Carlstadt south to Elizabeth. This river, possibly the prehistoric bed of the Hackensack, flowed directly under what is now the city of Newark.

In this connection, it is of more than passing interest to note that the heart of Newark—Broad and Market Streets—is 52 feet to bedrock! Thus the vast valley of the Hackensack was once far greater than present visible meadowland area would indicate.

So much for the generally-recognized "old Hackensack bed." What excited State Geologist Widmer was the clearly-defined depression snuggled up to Palisades to the east. This bed is at depths generally ranging between 140 and 190 feet under the peat surface of the meadowlands.

"Frankly," admits Dr. Widmer, "we don't know what this is. Maybe it's the way Overpeck Creek once flowed. Maybe it's another old bed of the Hackensack. Maybe it's a glacial

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Geological map of meadowlands was produced from those of State Geology Dept. which has charted all known borings in the area. Shaded strips indicate beds of two pre-glacial rivers which once ran through meadows, are now 100-200 feet below surface.

MEADOWLANDS

(Continued from Preceding Page)

gouging. Nobody ever suspected this before."

Today, of course, both these "beds of vanished rivers" are deeply hidden from view; the modern Hackensack River meanders placidly at surface level almost in the exact center of the widest part of the Jersey Meadows. Much has happened since those old prehistoric rivers lost their way; much water, literally, has flowed over the dam.

Perhaps it would be well to go back to the beginning. Well, not all the way back—only 150 million years or so.

Then what is now New Jersey was a much higher land formation. Continuing rains wore away the sandstone, washed it toward the seas and piled it in the valleys. Suddenly, deep, deep within the sandstone, molten volcanic lava began to run about 125 million years ago. For one thing, the lava ran to the surface and cooled rapidly to form what are now the three Watchung Mountain ranges.

EASTWARD of the Watchungs, the lava never reached the surface, cooling instead very slowly a mile or more underground. This formed the Palisades—and as the molten rock spread underground (far beneath what would now be the meadows), two "feeder pipes" of lava burst quickly upward until the pressure stopped and left them as two upright columns (still deep in the earth).

These two columns are Snake Hill and Little Snake Hill, not "stumps of eroded volcanoes" as often said, but

rather volcanic rock which shot upward through the earth like water under heavy pressure only to cool slowly some 6,000 feet below the surface of that area (and eventually, through erosion of softer materials, to come to view). Thus, while Snake Hill and Watchung rocks are chemically the same, and both make excellent trap rock, they are physically different because Snake Hill cooled very



Closeup of lava-formed rock formation at Snake Hill.

slowly and the Watchungs hardened very quickly.

Eons passed, until about one million years ago the first of four glaciers swept down over the "New Jersey" terrain. Of these only the last, the Wisconsin Glacier, materially changed the valley between the Palisades and the ridge to the west. This "baby" of glaciers, the Wisconsin, occurred a mere 70,000 or so years ago.

The vast sheet of Wisconsin glacier ice was in its declining centuries as it neared what is now New Jersey. It found in the Hackensack Valley a welcome easy path southward and the ice, 1,500 to 2,000 feet thick, crunched down the valley all the way to what is now Perth Amboy. As it moved between the mountains, the glacier dropped off layers of boulders or pebbles, and these filled in some low spots (and now underlay the clay).

EVENTUALLY the ponderous ice sheet waned, moving back to its far northern origin some 25,000 to 40,000 years ago. Behind, in the Hackensack Valley, if anyone was there to look, a great lake covered all. The lake, which geologists have called "Lake Hackensack," reached from Perth Amboy almost to Haverstraw, N.Y. Eastward were two other glacial lakes—one in the Hudson River valley, the other in the general area of Long Island Sound.

Just when Hackensack Lake was there and how it was held in place, no one can say for sure. Geologists disagree. A few question that a lake really was there, believing instead that a broad river flowed southward or that a giant fresh water bay inundated the region. The weight of evidence is with the lake, however. Certainly the water in the valley was fresh, whether river, bay or lake, because no salt water marine fossils ever have been found in the clays.

There is no disagreement on that score. Furthermore, the salty ocean was then some 90 miles east of where it is today.

Chester A. Reeds and Ernst Antevs, two geologists intimately interested in the Hackensack Meadows, gave the best proof of a giant lake in the 1920s with carefully documented studies of clays in the meadows. Prior to 1922, when Mr. Reeds began his investiga-

tion on the clays of the Hackensack basin, glacial Lake Hackensack had not been outlined or recognized.

Dr. Antevs offered proof that the lake was in place for at least 2,550 years when core drillings in the Hackensack Meadows near Little Ferry in 1922 showed him 2,550 sharply defined layers (or "varves," with each varve composed of a summer accumulation and a winter deposit). Each varve (or two-part layer) represented one year, and by counting layers, the time to build up the clay could be reckoned as easily as a tree's age can be told by counting the rings.

IT is not far wrong to believe in "Lake Hackensack"; it is unlikely that such distinct varves could be found unless the water had some of the relative stability of a lake. Dr. Paul MacClintock, Princeton University geologist and internationally-consulted expert on the Ice Age, believes there was a "Lake Hackensack."

He isn't as ready, nevertheless, to say how the water was held in place or when the lake disappeared. Possibly the lake was dammed by the "terminal moraine" (the mounds of stone and boulders and debris at the edge of the ice sheet) and probably the crushing weight of the glacier pushed down the thin crust of the earth and formed a lake bowl. Then, when the heavy mass of ice retreated, the earth's surface rose to near its present position.

At any rate, Lake Hackensack disappeared, the clays lay bared to the weathering air and coursing fresh water streams gradually brought new life to the great lake bed. Vegetation covered the clay and in several areas broad cedar forests took root. Each of these latter years was a cycle, too, but instead of varves of clay, time built up layers of surface peat. All of

these combined in the most recent geological era.

So it was when the Dutch first set timid foot on the meadowlands in about 1650. Geology reckons three centuries as a mere wink of an eye; what has happened in historical time is but a tick in a geological day. Salt water, partially encouraged by man-dug ditches, has invaded the meadows to drive out fresh water vegetation, but peat builds up anyway.

IT would be intriguing to say that geology made man's task in the meadowlands well-nigh impossible. It isn't so; well-planned and carefully-executed construction can firm up those 2,700 years of clay and make them capable of supporting practically anything. They may shiver a bit and quake a bit if the "bull's liver" acts up, but they won't give and they won't sag or lean.

Indeed, they might be said to be practically as firm as Snake Hill, except that now there are doubts that Snake Hill will stand forever.

Snake Hill and its smaller twin, Little Snake Hill, stand as dramatic evidence of time so long passed as almost to be beyond the comprehension of most. Through geological time they withstood all forces, including vengeful ice sheets.

Possibly it was a standoff, at that, Snake Hill apparently stood some 100 feet higher before the coming of the Wisconsin glacier than it stood after the glacier waned (borings for the building of New Jersey Turnpike indicated that). The glacier took a little away but it couldn't dislodge rocky old volcanic Snake Hill and it

BIRTH OF A LEGEND

The Rock of Gibraltar and Snake Hill in the meadows are related—through the magic of an advertising man's inspiration.

Back in 1895 John F. Dryden, founder and president of the Prudential Insurance Co., asked the J. Walter Thompson agency of New York to find a symbol of "lasting, enduring strength." Another agency had tried for months and admitted failure.

Mortimer Remington, young Thompson account executive, was assigned the task. As the story goes, Remington had a brainstorm as he saw Snake Hill on a trip to Newark via the Pennsylvania Railroad. Here, almost within sight of the Prudential's home office, was the symbol! Certainly Snake Hill had "lasting, enduring strength;" geologists estimate its age as at least 125 million years.

From Snake Hill (not an ad-man's dream of a name) to the Rock of Gibraltar was an easy step. "The Rock" first appeared in Prudential advertising on August 20, 1896, and has been the insurance company's trademark since.

WHAT'S IN A NAME?

Snake Hill, that familiar volcanic outcropping, was called Siskakes (place where snakes dwell) by the Indians and Slanghenbergh (Snake Hill) by the Dutch.

As for the snakes, they were real. Consider this eyewitness account of the 1870s written by L. E. Travis, then editor of The Bayonne Evenings News.

"The marshland which borders the hill was literally infested with black water snakes, many of them 10 to 12 feet long. . . . While investigating the Hackensack River side of Snake Hill in a rowboat (I saw) the Snake Hill shoreline actually, not figuratively, alive with huge snakes, some of them scintillating with the bronze-like blackness characteristic of these reptiles when in best condition. For not less than a quarter mile of shoreline, the steep bank was a mass of hissing, squirming, villainous water snakes, almost all of them black."

Today the snakes are gone; if there is a satisfactory answer it is not a matter of general knowledge. Perhaps a reader has the answer?

didn't push Little Snake Hill around too much either.

PASSING generations have chipped away at this craggy mound by the Hackensack River. Convict labor for years picked and blasted at the trap rock and crushed it into little stones for Hudson County roads, and the rock quarrying continued here until about World War II.

The Greenwood Lake Division of the Erie Railroad cut a fraction away in the 1870s, the Pennsylvania Railroad sliced a bit more away as it completed its new line to New York in 1909. The New Jersey Turnpike builders in 1950 tore into the giant monadnock (an appealing geological term meaning a hill rising above the surrounding area because of its resistance to erosion).

Maybe the rugged rock will disappear. Hudson County last fall asked for bids for the excavation and removal of this mound that nature so violently wrought. At the time, officials spoke casually of Snake Hill as so much trap rock—20 million tons of it. They spoke of how much it would bring and should bring and who should profit from it and whether there was chicanery at the bid making.

That sounds like the end one day of Snake Hill. When people get to thinking of a lava-formed veteran as merely so much trap rock (or so much gold), it's doomed.

Next Week: Reclamation and Frustration.



Rare old photograph shows schooner on Hackensack River at turn of century "near Welch's kiln sheds." At left, another old photo shows workmen loosening clay at Welch pits by use of wedges. Clay was used in brickmaking, a great industry in the Little Ferry section in the 1890's.

